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Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 87/75

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Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 87/75

Assessment of the 1986 4WX herring fishery

by

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ABSTRACT

Reported landings from the 1986 herring fishery in NAFO Div. 4WX totalled 101,800 t, of which 73,700 t were attributable to the 4WX stock. The fishery continued to be dominated by the roe market and focused on the spawning grounds off southwest Nova Scotia (purse seine and gillnet). Smaller fisheries took place off southern New Brunswick (weir and purse seine) and off Cape Breton (purse seine).

Sequential population analysis, calibrated with larval abundance as in previous assessments, indicated an increase in stock biomass.

RÉSUMÉ

En 1986, les débarquements de hareng dans la Division 4WX de l'OPANO ont été de 101 800 t, dont 73 700 t provenant du stock de 4WX. La pêche a continué d'être dominée par le marché de la rogue et a été pratiquée principalement dans les aires de frai du large situées au sud-ouest de la Nouvelle-Écosse (senne coulissante et filet maillant). Une pêche hauturière de plus petite envergure a été pratiquée au sud du Nouveau-Brunswick (pêche à fascines et senne coulissante) et du Cap-Breton (senne coulissante).

L'analyse séquentielle de population, étalonnée à l'aide de l'abondance larvaire comme dans les évaluations précédentes, a indiqué une augmentation de la biomasse.

INTRODUCTION

The 1986 herring fishery in NAFO Div. 4WX was similar to that in recent years. Purse seine was the major gear type, followed in importance by weirs, gillnet, traps, shutoffs and midwater trawl (Table 1). The major portion of the fishery took place off southwest Nova Scotia (4Xa; June-October) with smaller concentrations of effort off southern New Brunswick (4Xb; June-January) and off Cape Breton (4W Chedabucto Bay; November-February) (Fig. 1).

The fishery continued to be influenced strongly by markets, and dominated by the Japanese roe market.

1986 Management Plan

The 1986 Scotia-Fundy Region Herring Management Plan (Appendix 1) established a quota of 97,600 t. A total of 92,600 t was for the purse seine fleet, allocated among temporal components of the fishery in the traditional manner (Chedabucto Bay (4W), 4X summer and winter) and 5000 t was allocated to the drift gillnet sector. The remaining inshore gear components of the summer fishery (fixed gillnets, NS weirs and traps) were removed from the quota. They were allowed, on the basis of previous performance, an estimated 13,000 t, for a total projected catch in the plan of 110,600 t. The removal of inshore fixed gear from quota (to allowance) was to overcome the traditional 80% purse seine/20% inshore gear breakdown in quota allocation; the inshore gear allowance was recognized as being about the market capacity for those segments, and kept the estimated total catch near the biological advice (100,000 t). As in previous years, the N.B. weir and shutoff fishery (considered to be on non-stock fish, i.e. from the Gulf of Maine stock) and a portion (50%) of the fall 4X purse seine fishery (around Grand Manan) were not included in the quota.

Description of the Fishery

4Wa (Chedabucto Bay, Winter) Purse Seine Fishery

In accordance with the 1986 Management Plan, this fishery was open from November 7, 1985 to March 1, 1986, with a quota of 18,000 t. The reported catch of 9080 t was considerably lower than the quota, mainly because of market limitation. An acoustic survey of the area (Buerkle 1987) showed a large and persistent group of fish in the general area.

4Xb (Bay of Fundy) Fall and Winter Purse Seine Fishery

The Bay of Fundy "fall and winter" fisheries were open from October 16, 1985 to March 31, 1986. A total of 7000 t was assigned in two segments: 6000 t before December 31 and 1000 t for the traditional "brit" fishery after January 1. Only 50% of the landings in the October-December segment were applied to the quota. The amount recorded (3365 t) was somewhat lower than the landings in recent years (~5000 t), the same as in 1984, but lower than the landings (10,000-40,000 t) between 1965 and 1975.

4Xa (Southwest Nova Scotia) Summer Fishery

a) Purse seine

The 1986 Management Plan limited this fishery to the period June 1 to October 14, 1986 with a quota of 90,000 t, minus what had been taken in the

4W and 4X fall and winter fisheries. Nominal landings of 56,145 t were 35% lower than in the previous year. This was due primarily to market conditions, particularly dependence on the roe market. Logbook analysis (Power and Stephenson 1987) shows that fewer trips were made than in the previous year (particularly early in the season). Catch rates generally remained high.

b) Gillnet

The gillnet segment of this fishery took 3533 t, only 2/3 of what it took in 1985. Once again, the fishery was hampered by a lack of shore-based market and relied on a foreign over-the-side sale program.

c) Weirs

Nova Scotia weirs recorded 1958 t, a substantial decrease (-50%) in catch compared to 1985, but similar to the catch in 1984.

4Xb (New Brunswick) Weir and Shutoff Fishery

The New Brunswick weir and shutoff fishery recorded 27,886 t, almost exactly what was taken in 1985. Again the weirs of Grand Manan Island dominated. Few fish were taken in inner weirs (Passamaquoddy Bay, Campobello and Deer Islands and along the shore to Saint John).

Catch Statistics

Reported landings for the 1986 fishery (DFO, Scotia-Fundy Region, Statistics Div. records) are listed by month and gear segment in Table 2. Long-term trends in landings by the major gear segments are shown in Table 3. Recorded landings for the stock in 1986 were 73,733 t, the second lowest value in the last two decades.

Trends in reported stock, adjusted stock and total 4WX (stock + non-stock) landings and in TAC are as follows ('000 t):

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
TAC	-	-	-	-	109.0	110.0	99.0	65.0[1]	100.0	80.2	82.0	80.0	125.0	97.6[2]
Reported stock[3] catch	122.7	149.7	143.9	115.2	117.1	95.9	59.0	79.6	87.7	84.7	84.4	78.1	112.4	73.7
Adjusted stock[4] catch						114.0	77.5	107.0	137.0	105.8	117.4	135.9	112.4	73.7
Reported total catch	142.6	170.3	174.7	143.9	150.7	134.7	96.2	93.1	106.8	110.7	94.1	88.7	141.9	101.8

[1]TAC raised from 60.0 t to 65.0 t in mid-season.
[2]Excludes an allowance of 13,000 t for inshore 4Xn fixed gear.
[3]Excludes 4Xb wier + shutoff, 4Xn gill + trap, 4W inshore gear.
[4]Includes 1978-1984 adjustment for misreporting and omissions.

Logbook Information

The new logbook design introduced for the 1985 fishery was used again in 1986. Coverage was good (92% of catch) as logbook submission was again a condition of the fragmented license scheme, and logs were generally complete. The results are dealt with in detail by Power and Stephenson (1987).

Research Surveys

(i) Acoustic survey

An acoustic survey of overwintering herring in Chedabucto Bay, N.S., has been undertaken using the same survey strategy in each of the last 4 yr (Jan. 1984-1987) (Buerkle 1987). In 1985, ice cover disrupted the survey, but other years can be considered comparable. These show an increase in estimated biomass as follows (from Buerkle 1987):

Year	1984	1986	1987
Acoustic scatter (m^2 sr^{-1})	111,539	160,135	238,329
Acoustic biomass ('000 t)	424	568	789

(ii) Larval herring survey

The 1986 larval survey of the Bay of Fundy and eastern Gulf of Maine was undertaken between Oct. 21 and Nov. 15. The standard survey of 115 stations was completed successfully. The standard larval abundance index (geometric mean number of larvae per m^2 to bottom of the 115 stations) was very near that calculated for 1985 and the second highest value in the series (Table 4).

(iii) Experimental offshore fishing

Surveys were continued on offshore banks suspected of having herring of potentially different stock origin. These focused on two areas: offshore Scotian Shelf banks (particularly Emerald and Western Banks) and Georges Bank. Results of these surveys are presented by Stephenson et al. (1987). Spawning herring were found on both Georges Bank and Western Bank.

ASSESSMENT INPUT DATA

Stock Components

As in previous assessments (e.g. Sinclair and Iles 1981; Stephenson et al. 1986), the 4WX fishery is divided into "stock" and "non-stock" components (Table 2). "Stock" fish are considered to belong primarily to the major SW Nova Scotia spawning groups, but this unit also encompases smaller local stocks (e.g. Grand Manan, Scotts Bay). The "non-stock" component is comprised of:

4Xb (N.B.) weirs 4Xb (N.B.) shutoffs	- considered for assessment purposes to be migrants from the 5Y stocks
4Xa miscellaneous	- small localized Nova Scotia South Shore stocks caught in 4Xm gill, 4Xm trap and bycatches in handline and longline fisheries
4W miscellaneous	- 4W fish taken in gear other than purse seine, on the assumption that the fish are from local stocks.

Also, as in previous assessments, those segments of the fishery which span the winter months (4Wa and 4Xb purse seine) are considered on a quota year basis (October 15, 1985-October 14, 1986). All other segments are considered for the calendar year 1986.

Biological Sampling

As in previous years, sampling of commercial catches was stratified by area, gear segment and month following the guidelines of:

1) obtaining as many length frequencies from individual catches as possible; and

2) stratified "detail" samples (two fish per half cm size-class above 24 cm; one per half cm size-class below 24 cm) to a level of at least 200 fish per area, gear and month.

Sample coverage was high and resulted in 555 length frequencies 94,000 fish) and 12,591 fish analyzed in detail (including ages); however, some cells (area and gear by month) were undersampled according to the previous criteria (Table 5).

Biological samples were matched to landings by gear component on a monthly basis as in previous assessments. Numbers at age from commercial catches were generated on the St. Andrews HP 3000 in the traditional manner, using programs HERNLW02 and HERNAG09. For all gear components except 4Xa purse seine, length-frequency samples were applied on a monthly basis.

A correction of 2% was applied to length measurements to account for shrinkage due to freezing. This is within the range values observed in several studies in Scotia-Fundy and Gulf Regions summarized by Hunt et al. (1986).

Since the summer purse seine fishery involves several distinct fishing grounds and markets, including directed effort for ripe (roe) fish, a smaller spatial scale was considered necessary. As in the previous assessment, length frequencies were matched by individual 10' square and month. Catches were partitioned by square on the basis of logbook information and where samples and catches did not coincide, length-frequency information from adjacent squares was used (see also Power and Stephenson 1987).

Age Composition

The age composition of the nominal catch in major gear segments of the fishery is presented in Table 6. The 1982 year-class (age 4) again dominated the 4WX stock by number and, this year, dominated also by weight. Age 2 fish dominated the 4WX non-stock (primarily 4Xb) fishery in number but age 3 (1983) was dominant in weight.

Quality of Catch Information

Previous assessments (Stephenson et al. 1985, 1986) have dealt at length with changes in the quality of catch information from this fishery. In 1984, (and a few preceeding years) misreporting was considerable and an adjusted catch biomass (1.7 times that reported) was used in assessment (Stephenson et al. 1985). In 1985, drastic measures were taken to curb misreporting including:

- an increase in the TAC (to reduce the need or incentive to misreport)
- increased monitoring including nightly verbal hails before landing, as well as collection of delivery slips, purchase slips and log records.
- fragmented (weekly) license scheme.

The result was a significant improvement in the amount and quality of statistical information on which to base the assessment, and it was considered unnecessary to adjust the 1985 catch figures (Stephenson et al. 1986).

In 1986, the TAC was slightly lower but large enough to reduce the need to misreport. A monitoring structure similar to that in 1985 (including nightly verbal hails prior to landing and a fragmented license scheme) was implemented, but wharf monitoring was lower. Misreporting was higher than in 1985 (particularly early in the summer purse seine fishery) but decreased later when it was apparent that the TAC and, more importantly, individual vessel quotas would not be met. Estimates of misreporting range as high as 30% but the general impression (from personnel in Fisheries Operations) is that misreporting was not more than 15-20%.

Abundance Indices

a) CPUE

As a result of the new purse seine logbook introduced in the 1985 fishery, a set of CPUE indices were presented at the last assessment (Power and Stephenson 1986). We have analyzed the 1986 logbooks in the same manner (Power and Stephenson 1987) and are now able to make some comparisons (Tables 7, 8). The 1986 data set shows fewer trips (particularly early in the summer fishery), presumably the result of very limited adult herring markets other than roe. Set rate was similar, indicating that fish were not harder to find. Lower catch per unit effort is linked to a higher rejection of fish as being unsuitable for market (higher releases).

b) Larval abundance

The larval abundance index (Table 5) was again calculated as the mean number of larvae per m^2 to bottom of the 115 standard stations as in the previous assessment.

ASSESSMENT PARAMETERS

A) Weights at Age

We have extended the series using average July weights at age compiled for the previous assessment (Table 9). The 1986 weight at age (mean July, for stock fish weighted by gear) are:

	1985 weights at age (kg)								
Age	2	3	4	5	6	7	8	9	10
	.055	.124	.182	.239	.271	.306	.329	.360	.400

The historical record of weights at age used in previous assessments is presented in Table 10.

B) Catch Matrix

The catch matrix (Table 11) is an extension of the "adjusted" matrix (1973-84 adjustment to account for misreporting, omissions and previous errors: Mace (1985)) used in the previous two assessments (Stephenson et al. 1985, 1986).

C) Partial Recruitment

The historical series of PR values and reasons for their change are summarized in Table 12.

A flat-topped partial recruitment vector was chosen for 1986. Ages 4+ were considered to be fully recruited. Age 3 was considered to have a value of .75 (based upon partial maturity and consistent with earlier years). The values for age 1 and 2 were set to yield geometric mean recruitment.

D) Natural Mortality

Natural mortality was assumed to be 0.2.

ASSESSMENT RESULTS

SPA

Sequential population analysis (SPA) was calibrated with larval abundance as in previous assessments. Tuning was based upon the best combination of high correlation, low intercept and minimum residuals (Table 13, Fig. 3). Regression of larval abundance on mature and 5+ biomass (as in 1986) gave an F value of about .1. These indicated an intercept not significantly different from zero. Regression forced through the origin suggested an F near .2. The 1986 point was off the line (the biomass estimates were higher than predicted by the larval abundance) but there was no reason to discount the point. An F of .15 was chosen by minimizing the residuals of the last two points (1985 and 1986).

Cohort analysis (COHORT of Rivard 1982, Table 14) indicates a considerable increase in stock biomass. The trend in age 2+ population biomass ('000 t) is as follows:

	1975	1976	1977	1978	1979	1980	1981
2+ biomass	456.6	370.8	274.6	234.4	350.7	358.6	303.5

	1982	1983	1984	1985	1986
2+ biomass	280.4	284.4	345.1	496.3	615.2

According to this analysis, 4+ fishing mortality in 1985 was .45, double that generated by the 1985 cohort analysis. The 1983 and 1984 year-classes are stronger than predicted in the last assessment.

Catch Projections

Projections are presented in Appendix II.

MANAGEMENT CONSIDERATIONS

This analysis indicates a low fishing mortality, which is consistent with most observations from the fishery, including lack of market, high larval abundance, high acoustic biomass, a consistent overall set rate and a high release rate in the purse seine fishery. On the other hand, the analysis is weakened by evidence of misreporting and by the changes, which occurred in the Trinity Ledge fishery (particularly the lower purse seine catch rate), both of which indicate a possible higher F.

The steps taken in 1985 to reduce the level of misreporting resulted in a considerable increase in the quality of information which that assessment was based on. In 1986, the level of monitoring was less and there is evidence that misreporting occurred, particularly early in the season. No

adjustment was made in this assessment for misreporting but there is increased uncertainty caused by that misreporting. It should be noted, however, that an increase in catch to account for even the most extreme estimates of misreporting still results in low F (<.2).

The status of herring on offshore Scotian Shelf banks, in particular, the stock affiliation of large herring reported from Emerald, Western and Sable Island Banks has been questioned. In early October 1986, four commercial purse seine vessels made trips to Western Bank in response to reports of herring from groundfish draggers. Herring were found, and several successful sets were made. Fish were large (29-36 cm), between 4 and 9 yr of age and were in spawning condition. The herring are larger (and older) than those of the usual 4WX fishery (see details in Stephenson et al. 1987). Groundfish research survey data indicate a discrete aggregation on the Western/Sable Bank area in the fall - and the discovery of "ripe and running" fish there in 1986 indicates a discrete spawning unit. On the other hand, spawning had not been documented in the area previously, and the presence of egg beds and larvae have not been verified (a limited larval survey is planned for 1987). Little information exists on the size of this group of fish or of its distribution at other times of the year; length frequencies of herring taken in the spring from outer banks are similar and indicate possible affinity. Until such time as there is more evidence of a separate stock, this fishery should be considered part of the 4WX unit.

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Table 1. Gear types involved in the 1986 4WX herring fishery.

Gear	Landings nominal (t)
Purse seine	67,918
Weirs	29,470
Gillnet	4,318
Traps	296
Shutoffs	371
Midwater trawl	28
Misc.	103

Table 2. Catch (t) by gear component and month for the 1986 4WX herring fishery (data from DFO, Scotia-Fundy Region, Statistics Branch; Tape MFD00304).

Gear segment	1985 Oct	1985 Nov	1985 Dec	1986 Jan	1986 Feb	1986 Mar	1986 Apr	1986 May	1986 June	1986 July	1986 Aug	1986 Sept	1986 Oct	1986 Nov	1986 Dec	1986 Total	Quota year total
4WX stock																	
4Wa purse seine		1738	2523	4153									434[5]	2895[5]	1598[5]	9080	8414
4Xa purse seine	6705[5]								197	6871	18888	26990	3199			56139	56139
(domestic)	6705								197	6871	18488[6]	26980	3198				
(over side)											398[6]						
4Xb purse seine	1993	637		735									3188[5]	583[5]		4506	3365
4Xa gillnet[1]							3	41	12	25	1332	2120				3533	3533
(domestic)							3	41	12	25	413	736					
(over side)											919	1384					
4Xa (NS) weirs		11						385	403	71	704	390	5			1958	1958
4Xa (NS) traps[2]	13	1							99	134	33	28		2		296	296
4Xb midwater trawl				15	3	10										28	28
Stock total	1993	2375	2523	4903	3	10	3	426	711	7101	20955	29525	3203	2	0		73733
4WX non-stock																	
4Xb (NB) weirs	4825	2079	138	43				17		2480	10114	5994	6233	2564	67	27515	
4Xb (NB) shutoffs	288	306	44							3	174	111	83			371	
4Xab misc.[3]	2						1	1	8	19	4	10	1	7		51	
4W misc.[4]	2					1	38	115	31	21	6	4	1			217	
Non-stock total	-	-	-	-	12	-	61	300	294	5158	8827	7139	5117	2385	182	29475	
Total 4WX	2431	4271	2517	4548	467	6	101	956	2919	19398	42107	47725	11835	2397	182	141860	

[1] 4Xa gillnet includes 4XOQR (4Xm combined with 4Xa misc.).
[2] 4X traps includes Liverpool and other traps.
[3] 4Xa misc. includes 4Xm gillnet, handline + bycatches.
[4] 4W misc. includes all gear other than purse seine.
[5] Not included in totals for 1986 quota year.
[6] OSS total may have been 910; total purse seine is correct (I. Marshall, DFO, Yarmouth, pers. comm.).

Table 3. Historical series of annual landings (t) by major components of the 4WX herring fishery (1963-85 from Stephenson et al. 1986).

Year	4Wa	4Xa			4Xb		Stock total[1]
	Purse seine	Purse seine	Gillnet	Weir	Purse seine	shutoff & weirs	
1963		15093	2955	5345	6871	29366	
64		24894	4053	12458	15991	29432	
65		54527	4091	12021	15755	33346	86394
66		112457	4413	7711	25645	35805	150226
67		117382	5398	12475	20888	30032	156741
68		133267	5884	12571	42223	33145	196362
69	25112	84525	3474	10744	13202	26539	150462
70	27107	74849	5019	11706	14749	15840	190382
71	52535	35071	4607	8081	4868	12660	129101
72	25656	61158	3789	6766	32174	32699	153449
73	8348	36618	5205	12492	27322	19935	122687
74	27044	76859	4285	6436	10563	20602	149670
75	27030	79605	4995	7404	1152	30819	143897
76	37196	58395	8322	5959	746	29206	115178
77	23251	68538	18523	5213	1236	23487	117171
78	17274	57973	6059	8057	6519	38842	95882
79	14073	25265	4363	9307	3839	37828	59021
80	8958	44986	19804	2383	1443	13525	79584
81	18588	53799	11985	1966	1368	19080	87706
82	12275	64344	6799	1212	103	25963	84733
83	8226	63379	8762	918	2157	11383	84385
84	6336	58354	4490	2684	5683	8698	78083
85	8751	87167	5584	4062	5419	27863	112385
86	8414	56139	3533	1958	3365	27883	73733

[1]Includes all purse seine, 4Xa gillnet, 4Xa weir, 4Xa traps, 4Xb midwater trawl (see Table 2).

Table 4. Traditional 4WX larval herring abundance indices; from number of larvae per m^2 (to bottom) of standard stations sampled (n=115) for each year.

Year	Geometric mean
1972	2.64
1973	2.30
1974	7.60
1976	4.44
1977	1.83
1978	1.24
1979	2.18
1980	4.61
1981	1.40
1982	3.79
1983	3.32
1984	4.31
1985	6.63
1986	6.79

Table 5. Distribution of biological samples from the 1986 4WX commercial herring fishery; detail fish = number of fish taken for detail analysis including ageing, LF samples = number of length-frequency samples, LF fish = number of fish measured.

Gear component		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
4Wa purse seine	- detail fish		94*	163*	608											
	- LF fish		347	1050	4577											
	- LF samples		2	6	26											
	- catch (t)		1738	2523	4153											
4Xa purse seine	- detail fish									*	923	577	1096	605		
	- LF fish										6301	8248	5944	3669		
	- LF samples										34	46	37	23		
	- catch (t)									197	6871	18886	26990	3199		
4Xb purse seine	- detail fish	145*	96*		137*											
	- LF fish	976	426		759											
	- LF samples	6	3		5											
	- catch (t)	1993	637		735											
4Xa gillnet	- detail fish								0	0	0	53*	110			
(4XOQR)	- LF fish								144	235	607	5180	4235			
	- LF samples								1	2	6	26	20			
	- catch (t)							3	41	12	25	1332	2120			
4Xa NS weir	- detail fish								89*	42*	68*	259	33	54		
(4XR)	- LF fish								872	218	360	1449	137	352		
	- LF samples								4	1	2	10	1	2		
	- catch (t)								385	403	71	704	390	5		
4Xa NS trap	- detail fish								29	*	*					
(4XMOQ)	- LF fish								144							
	- LF samples								1							
	- catch (t)								0	99	134	33	28	0	2	
4Xb mid trawl	- detail fish				156	32	48									
	- LF fish				1499	322	855									
	- LF samples				8	2	5									
	- catch (t)				15	3	10									
4Xb weirs	- detail fish				44					12	1270	1730	969	1023	526	43*
	- LF fish				321					168	7377	12051	5951	5926	3288	314
	- LF samples				2					1	45	83	42	37	18	2
	- catch (t)				43					17	2480	10114	5997	6233	2564	67
4Xb shutoff	- detail fish											23*	86*	67*		
	- LF fish											173	444	304		
	- LF samples											1	2	2		
	- catch (t)										3	174	111	83		

*Cells undersampled according to criteria of 200 detail fish per gear type per month with >50 t catch.

Table 6. Catch at age in numbers (thousands) and b) weight (t) by gear component for the 1986 4WX herring fishery.

		1	2	3	4	5	6	7	8	9	10	11+	Total
4WX "stock"													
4Wa purse seine	No.	0	1868	18624	20965	6854	4883	1266	1279	570	177	18	56504
	Wt.	0	152	2143	2906	1261	1069	307	350	167	54	5	8414
4Xb purse seine	No.	0	11747	11484	6201	1256	1343	208	44	17	0	0	32300
	Wt.	0	516	1215	957	262	338	59	13	6	0	0	3365
4Xa purse seine	No.	40	50128	131869	147276	25062	12007	4771	1246	1142	565	170	374276
	Wt.	0	2894	16295	25781	5612	3108	1390	406	383	205	64	56139
4Xa gillnet	No.	0	23	4292	9524	2368	1547	310	106	32	78	4	18284
	Wt.	0	2	620	1816	529	399	95	34	12	24	2	3533
4Xa(NS) weirs	No.	0	14224	9435	2783	680	215	141	22	4	3	0	27507
	Wt.	0	386	887	437	145	53	38	7	1	1	0	1957
4Xa(NS) traps	No.	0	1	179	234	141	185	182	62	114	43	31	1172
	Wt.	0	0	17	45	34	50	57	20	42	18	13	296
4Xb(NB) midwater trawl	No.	0	2028	314	0	0	0	0	0	0	0	0	2342
	Wt.	0	19	9	0	0	0	0	0	0	0	0	28
4WX "stock" total	No.	40	80019	176197	186983	36361	20180	6878	2759	1879	866	223	512385
	Wt.	0	3968	21188	31943	7843	5018	1944	830	611	302	84	73732
4WX "non-stock"													
4Xb(NB) weirs	No.	3209	131055	118906	23902	10502	4536	2212	325	91	66	9	294813
	Wt.	62	6542	12453	4171	2360	1158	613	98	29	25	3	27515
4Xb(NB) shutoff	No.	1	5237	830	159	134	108	60	10	3	0	0	6542
	Wt.	0	194	75	28	29	26	15	3	1	0	0	371
4WX misc.	No.	0	14	1926	225	64	83	53	27	30	24	9	2455
	Wt.	0	1	144	35	16	23	17	9	11	9	4	268
4WX "non-stock" total	No.	3210	136306	121662	24286	10700	4727	2325	362	124	90	18	303810
	Wt.	62	6737	12672	4235	2404	1207	645	110	40	35	7	28153
4WX GRAND TOTAL	No.	3250	216325	297859	211269	47061	24907	9203	3121	2003	956	241	816195
	Wt.	62	10705	33860	36177	10248	6225	2590	940	651	337	91	101885

Table 7. General statistics on CPUE variables for the 1985 and 1986 4Xa summer purse seine fishery (from Power and Stephenson 1987).

Variable name	Number of observations		Mean		Standard deviation		Minimum		Maximum	
	1985	1986	1985	1986	1985	1986	1985	1986	1985	1986
Total catch (mt)	1802	1425	46.2	36.2	38.1	28.3	0	0	562.5	200.0
Kept catch (mt)	1802	1425	44.6	35.3	35.0	26.6	0	0	224.0	200.0
Released catch (mt)	1802	1425	1.6	0.9	14.7	8.9	0	0	471.7	158.7
Total trip hours	1494	1136	12.2	12.7	3.9	3.9	1.0	1.5	36.0	35.1
Total search hours	1177	1005	4.4	4.5	2.8	2.7	0.1	0.1	14.5	16.5
Catch per hour (mt)	994	902	26.6	18.0	41.8	28.9	0.2	0.2	590.0*	363.0
Catch per set (mt)	1539	1258	41.2	31.4	25.1	18.8	0.9	0.9	187.5	172.4
Release per hour (mt)	44	16	13.0	24.4	18.6	33.2	0.3	0.1	113.4	130.4
Release per set (mt)	68	25	26.3	33.8	25.6	33.0	0.6	0.5	157.2	136.1
Kept per hour (mt)	980	898	26.4	17.6	41.8	28.0	0.2	0.2	590.0*	363.0
Kept per set (mt)	1519	1252	40.6	30.9	24.4	17.6	0.9	0.9	164.2	131.5
Sets per hour	1054	940	0.6	0.6	0.7	0.9	0.1	0.1	10.0	10.0

*Result of one set with 0.1 hours searching and a catch of 59.0 mt.

Table 8 4Xa purse seine effort and CPUE by fishing ground, 1986 and 1985 (in parentheses) (from Power and Stephenson 1987).

Fishing ground	Days fished	Total mt caught	Hours searched	Number of sets	Set/h	Catch/h	Catch/set
Grand Manan	104 (91)	3023 (3583)	284 (184)	107 (91)	.81 (.73)	22.8 (27.8)	29.8 (40.6)
Long Island	82 (30)	2739 (857)	266 (149)	97 (25)	.75 (.44)	21.6 (15.8)	30.1 (38.0)
Trinity	473 (808)	13419 (35721)	1650 (2106)	519 (1028)	.41 (.70)	11.1 (28.5)	28.6 (39.4)
Lurcher	1 (9)	0 (308.2)	8 (39)	0 (8)	0 (.18)	0 (10.5)	0 (46.8)
SW Ground	72 (150)	2251 (5675)	211 (526)	68 (199)	.84 (.46)	30.8 (16.7)	35.6 (34.2)
Seal Island	198 (236)	8420 (13142)	503 (671)	283 (328)	.61 (.59)	19.9 (29.1)	34.0 (44.7)
German Bank	273 (248)	13215 (15239)	858 (660)	467 (363)	.60 (.62)	21.0 (30.9)	34.9 (49.8)
Other	222 (230)	8501 (8790)	740 (823)	309 (253)	.59 (.46)	18.1 (19.7)	31.0 (39.1)
Total	1425 (1802)	51571 (83317)	4519 (5157)	1850 (2295)	.58 (.62)	18.0 (26.6)	31.5 (41.2)

Table 9. July weights at age for the 4WX herring fishery (stock portion); 1965-86. Values for 1968-78 from Sinclair et al. (1980, CAFSAC Res. Doc. 80/21); values for 1965-67 and 1979-83 are averages for the period 1968-78 (as in Iles et al. 1984, CAFSAC Res. Doc. 84/72); 1984 to 1986 values calculated from the respective fishery (Stephenson et al. 1986 CAFSAC Res. Doc. 86/43).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	10	10	10	0	0	0	0	0	0	0	0	0	0	0	10	10	10
2	41	41	41	33	37	32	66	44	29	48	21	33	65	28	41	41	41
3	112	112	112	112	106	119	143	138	106	110	94	114	113	112	112	112	112
4	172	172	172	148	162	169	199	192	143	175	179	159	174	181	172	172	172
5	218	218	218	185	207	211	230	225	225	206	216	233	214	229	218	218	218
6	254	254	254	244	242	257	254	262	252	240	240	249	274	259	254	254	254
7	286	286	286	276	282	292	293	292	279	277	268	277	293	302	286	286	286
8	323	323	323	399	306	332	329	322	331	322	333	317	325	330	323	323	323
9	354	354	354	338	334	369	362	345	360	342	358	382	328	351	354	354	354
10	389	389	389	410	390	389	388	380	389	352	379	404	416	397	389	389	389

	1982	1983	1984	1985	1986
1	10	10	0	0	0
2	41	41	38	53	55
3	112	112	132	118	124
4	172	172	191	204	182
5	218	218	229	249	239
6	254	254	259	278	271
7	286	286	280	315	306
8	323	323	296	334	329
9	354	354	309	344	360
10	389	389	364	440	400

Table 10. Mean weight at age for 4WX herring as presented in annual assessment documents for 1973-85.

Age	1973 ICNAF Res. Doc. 74/13	1975 ICNAF Res. Doc. 76/VI/45	1976 CAFSAC Res. Doc. 77/11	1977 CAFSAC Res. Doc. 78/25	1978 CAFSAC Res. Doc. 79/19	1979 CAFSAC Res. Doc. 80/47 . Option 1	1980 CAFSAC Res. Doc. 81/10[a]	1981 CAFSAC Res. Doc. 82/36[b]	1982 CAFSAC Res. Doc. 83/89[c]	1983 CAFSAC Res. Doc. 84/72[d]	1984 CAFSAC Res. Doc. 85/78[e]	1985 CAFSAC Res. Doc. 86/43[e]
1	-			-	9	10.64	9.5	-	8.54	10	-	-
2	31			29.6	30	24.37	35.5	19	51.79	41	37.5	53
3	114			97.7	93	93.93	86.9	35	137.42	112	132.1	118
4	159	"as per	"mean wts	165.8	159	164.75	173.4	172	176.26	172	191.4	204
5	227	assessment	from 4XWb	207.1	205	226.00	220.7	216	229.67	218	228.7	249
6	270	presented	were used"	261.5	250	253.13	258.3	202	256.34	254	259.1	278
7	299	in Jan.		280.7	285	285.86	305.3	262	287.47	286	279.8	315
8	334	1976"		300.2	315	314.75	333.0	325	319.62	323	296.2	334
9	360			328.6	341	343.85	359.2	362	362.61	354	309.0	344
10	386			349.0	382	369.52	369.7	385	377.64	389	364.0	440

[a]Also first use of 'Mean July 1969 to 1978' as used in 'W83'. Used both 'Fishery' and 'Mean' in cohort mean for projections.
[b]As for a), i.e. fishery and mean for cohort and YPR but mean for projections.
[c]Used 'mean July 1969 to 1978' only. No fishery weights calculated.
[d]Also used mean July 1969 to 1978 weights which are different from a).
[e]Mean July weights at age (stock fish weighted by gear).

Table 11. Catch matrix (no. x 1000) for the stock portion of the 4WX herring fishery (includes adjusted 1973-85 portion used in last assessment; Stephenson et al. 1986).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	270378	154323	722208	164703	108875	699720	87570	0	754	14151
2	1084719	914093	613970	2389061	290329	576896	404224	649254	126421	596153
3	34835	448940	153626	224956	531812	76532	183896	71984	595992	72381
4	234383	73382	266454	83109	132319	286278	106630	148516	109530	616622
5	49925	321857	110051	290285	162439	201215	113566	77207	34422	53199
6	10592	45916	159203	73087	112631	120280	75593	75384	25562	15254
7	1693	13970	57948	90617	62506	111937	93620	49065	19361	8120
8	561	7722	4497	31977	22595	41257	50022	48700	17604	5313
9	54	1690	409	15441	6345	21271	36618	26055	19836	10964
10	37	215	296	5668	2693	7039	7536	13792	9661	5787
11	1	1	148	1175	722	2674	5695	11679	11120	7359

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	2870	240	1164	35381	311	1623	0	3589	3367	0
2	264491	48470	140494	346719	170523	79566	75713	72591	128378	72301
3	180898	176226	28659	36177	226442	60559	33174	122380	101017	141067
4	92487	130598	192958	11338	47200	359484	68816	17756	168379	131251
5	384646	72334	106061	107627	4639	21958	306716	73025	16946	84920
6	50599	219788	55066	60431	19695	3583	21728	154542	41607	13633
7	9357	18960	150588	27286	15521	3507	1631	10910	63468	13803
8	3238	4967	12466	96741	9981	4951	1914	1535	7334	16299
9	3481	3556	2873	9838	35386	2009	1366	977	1351	5418
10	2842	1835	1253	2169	3834	8179	361	886	434	1263
11	4599	3071	3448	1499	2042	2105	1442	719	895	5207

	1985	1986
1	5762	40
2	138419	80019
3	215599	176197
4	193369	186983
5	94308	36361
6	27081	20180
7	8989	6878
8	11609	2759
9	5107	1879
10	767	866
11	300	223

Table 12. Historical summary of partial recruitment values used in 4WX herring assessments.

Fishery year	PR 1	2	3	4	5	6	7	8	9	10	Notes	Reference (Res. Doc. #)
1985	.003	.4	.75	1	1	.5	.5	.5	.5	.5	"Chosen after consideration of the historical F matrix. This indicated a dome-shaped partial recruitment pattern with full recruitment at age 4."	Stephenson et al. (1986) (86/43)
1984	.002	.5	1	1	1	1	1	1	1	1	"changed from previous years after consideration of the population structure of the overwintering aggregation of herring in Chedabucto Bay, the pattern of the fishing mortality matrix and the increase in directed effort for small fish (as a result of low 4Xb weir landings in 1983 and 1984)."	Stephenson et al. (1985) (85/78)
1983	.01	.22	.53	1	1	1	1	1	1	1	Ages 1-2; F's fixed to generate mean recruitment Ages 3-10: "assumed to be identical to the last assessment."	Iles et al. (1984) (84/72)
1982	.01	.22	.53	1	1	1	1	1	1	1	"conform more closely with the pattern of recruitment at age for herring generally."	Iles and Simon (1983) (83/89)
1981	.001	.5	.53	.77	1	1	1	1	1	1	Using average F values for years 1975-78; "The mean F's for ages 5.10 for this time period were averaged and divided into the mean F's for ages 1, 2, 3 and 4, respectively."	Sinclair et al. (1982) (82/36)
1980 a	0	.8	.6	.9	1	1	1	1	1	1	Average conditions	Sinclair and Iles (1981) (81/10)
b	.006	.4	.23	.9	1	1	1	1	1	1	"appears more representative of the most recent years 1978 to 1979."	

Table 13. Results of tuning runs - 4WX herring: Intercepts, r, and residuals of the regression of SPA derived biomass vs larval abundance.

Terminal F	SPA mature biomass r	Intercept	Residual (sum of squares last 4 yr)
.1	.77	61391	.182
.2	.60	122930	.287
.3	.40	143377	.422

Table 14. 4WX herring: a) population numbers (thousands), b) population biomass (t) and c) table of F values from sequential population analysis.

a) POPULATION NUMBERS 11/ 8/87

	1973	1974	1975	1976	1977	1978	1979	1980
1	2366298	1646024	242348	719528	4195972	1255952	396585	1502751
2	938681	1936440	1330992	195524	588382	3434313	996273	324386
3	4417765	617008	892259	802311	109776	342863	2464672	649205
4	503004	2910227	420465	513515	469996	61310	243716	1791338
5	122136	293426	1655518	231506	281284	187113	38518	150115
6	70163	63687	178458	889790	127284	122408	42708	26623
7	53544	29998	34867	86116	485243	57909	38319	14026
8	57780	23890	15302	17418	51088	236904	19282	14855
9	57709	28984	13619	8538	9220	29181	95355	5078
10	37270	25649	12161	6827	3415	4680	13863	40620
1+	9624350	7575331	4795990	3471074	6322159	5732631	4349291	4518999
2+	6258052	5929307	4553642	2751546	2126188	4476679	3952706	3016248
3+	5319371	3992867	3222649	2556022	1537805	1042366	2956434	2691861
4+	901606	3375859	2330390	1753711	1427529	699504	491762	2042656

	1981	1982	1983	1984	1985	1986
1	1502889	1693033	3172898	2907395	1856218	98095
2	1228232	1230462	1382891	2592783	2380374	1514529
3	254272	912347	915003	958774	2042774	1823639
4	458669	162139	610549	613119	564612	1477399
5	1037648	282561	112263	279089	298976	287297
6	97632	441037	142481	69760	96306	159447
7	17841	50095	170131	61750	36560	54345
8	7238	12419	27779	57872	30963	21800
9	6227	3423	8285	13377	21775	14846
10	1456	3363	1577	5220	2342	13207
1+	4612104	4790879	6543857	7559140	7330900	5464605
2+	3109215	3097845	3370960	4651744	5474682	5366509
3+	1880982	1867383	1988068	2058961	3094308	3851981
4+	1626711	955036	1073065	1100187	1051535	2028342

Table 14. (cont'd)

b) MEAN POPULATION BIOMASS (t) 11/ 8/87

	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	3593	13609	13621
2	22079	64280	21724	4858	29655	82713	33226	11304	43561
3	381758	56474	64646	70903	9427	32562	236335	61424	22933
4	55722	390125	56679	61384	53504	8865	33222	237424	62528
5	20161	47534	265897	40665	40807	22345	7021	26596	152015
6	11888	11476	30364	166400	24154	18723	6543	5573	18095
7	10255	6052	6725	18596	101484	10611	7082	2935	4280
8	13824	5887	3863	4089	12725	51359	3438	3205	1646
9	14229	6632	3519	2138	2197	7224	22706	1026	1646
10	10809	6907	3426	2074	976	1160	3978	12216	404
1+	540725	595367	456845	371107	274930	235564	357144	375811	320729
2+	540725	595367	456845	371107	274929	235564	353551	362202	307108
3+	518646	531087	435120	366249	245274	152850	320325	350398	263546
4+	136888	474613	370474	295346	235847	120288	83990	238974	240613

	1982	1983	1984	1985	1986
1	15327	28731	0	0	821
2	43663	47475	86571	110396	73329
3	84154	84450	98306	205901	193609
4	23336	72827	83720	83700	226877
5	44601	19474	39282	55343	58028
6	72237	24525	13315	20409	36461
7	10824	29774	12481	8996	14012
8	3299	6366	10938	7327	6049
9	843	2349	1957	5896	4512
10	932	424	1302	760	4455
1+	299217	316395	347872	498728	618153
2+	283889	287664	347872	498728	617332
3+	240226	240189	261301	388332	544002
4+	156072	155739	162995	182431	350394

Table 14. (cont'd)

c) FISHING MORTALITY 11/ 8/87

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	.000	.012	.015	.000	.000	.032	.001	.002	.000	.002	.002	.000
2	.220	.575	.306	.377	.341	.132	.228	.044	.097	.096	.166	.038
3	.217	.184	.352	.335	.383	.141	.119	.147	.250	.202	.200	.330
4	.339	.364	.397	.402	.721	.265	.285	.346	.284	.168	.583	.518
5	.451	.297	.421	.398	.632	1.277	.169	.230	.656	.485	.276	.864
6	.650	.402	.529	.406	.588	.961	.913	.200	.467	.753	.636	.446
7	.607	.473	.494	.322	.517	.900	.748	.462	.162	.390	.878	.490
8	.490	.362	.383	.436	.360	.710	1.134	.669	.549	.205	.531	.777
9	.611	.669	.491	.716	.478	.544	.653	1.049	.416	.575	.262	1.542
10	.418	.362	.426	.401	.603	.630	.443	.339	.518	.522	.588	.610
4+	.425	.363	.426	.402	.607	.876	.476	.340	.533	.546	.601	.626

	1985	1986
1	.003	.000
2	.066	.060
3	.124	.112
4	.476	.150
5	.429	.150
6	.372	.150
7	.317	.150
8	.535	.150
9	.300	.150
10	.444	.150
4+	.445	.150

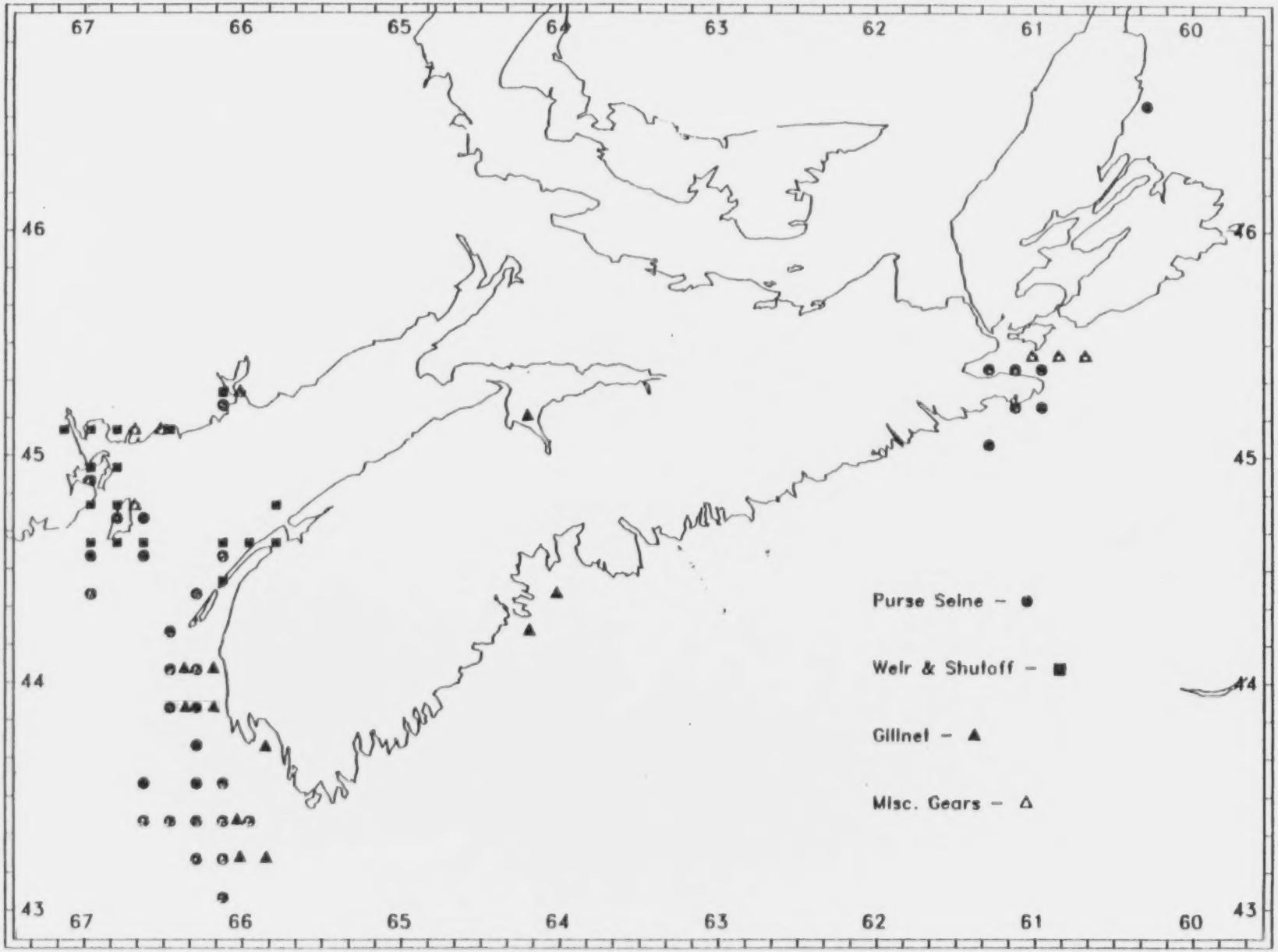


Fig. 1. Geographical distribution of gear components of the 1985 4WX (and 4Vn purse seine) herring fishery (from biological sample data; resolution = 10' square).

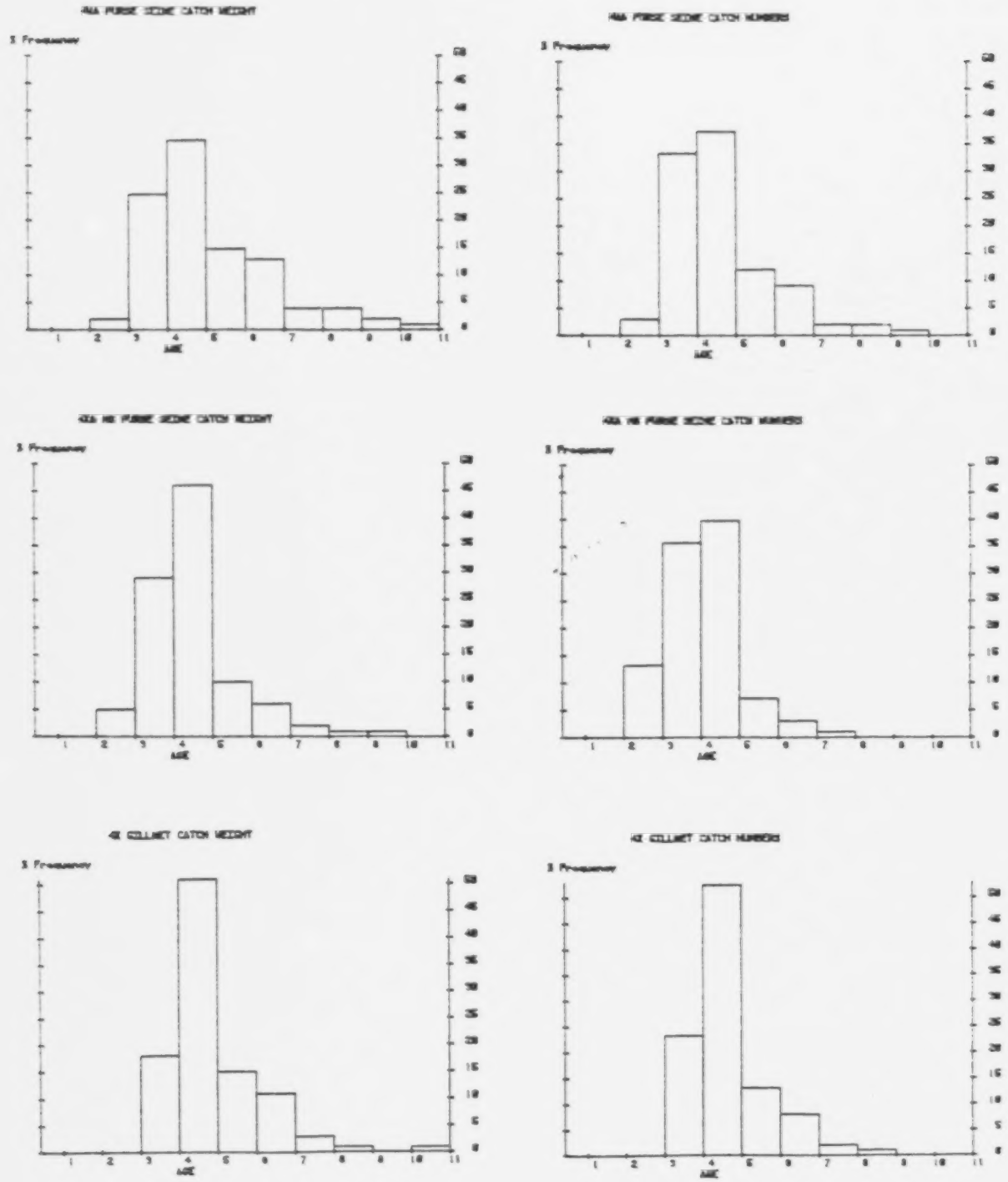


Fig. 2. Relative frequency (%) of numbers and weights by age in gear segments of the 1985 4WX herring fishery.

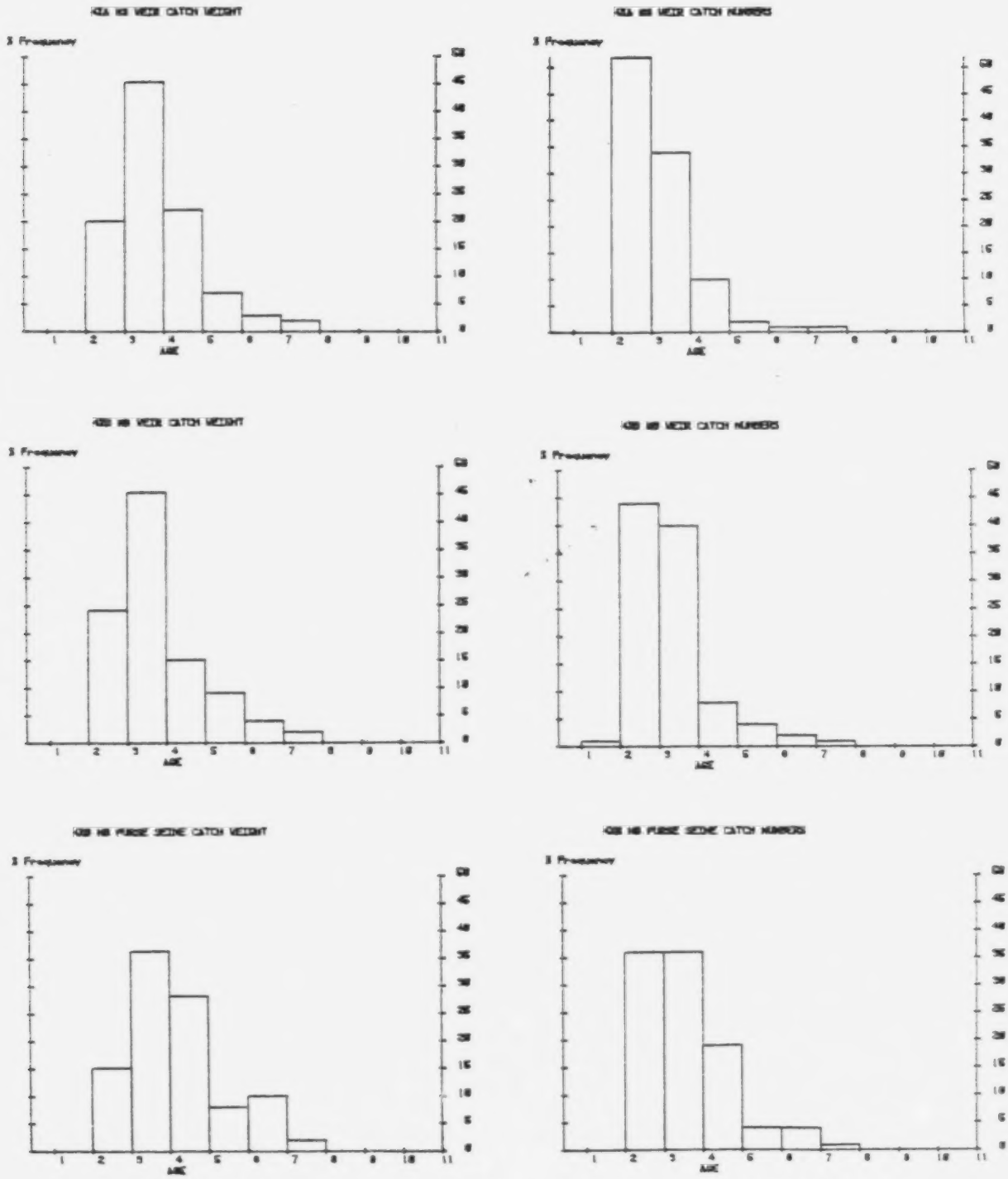
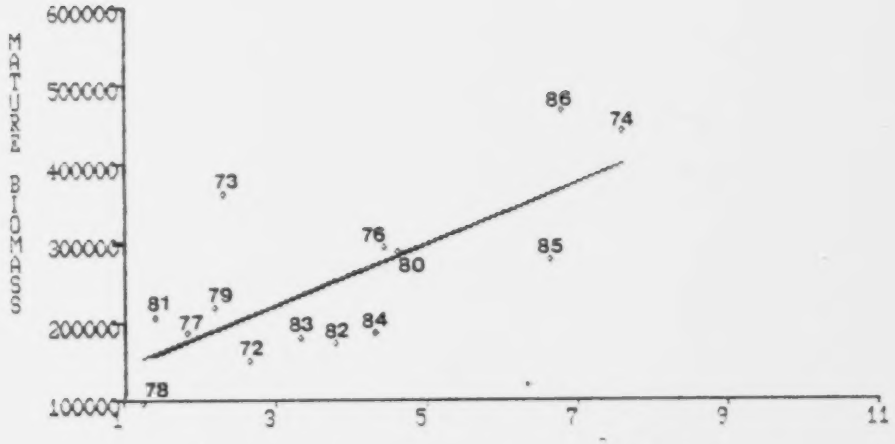


Fig. 2 (cont'd).



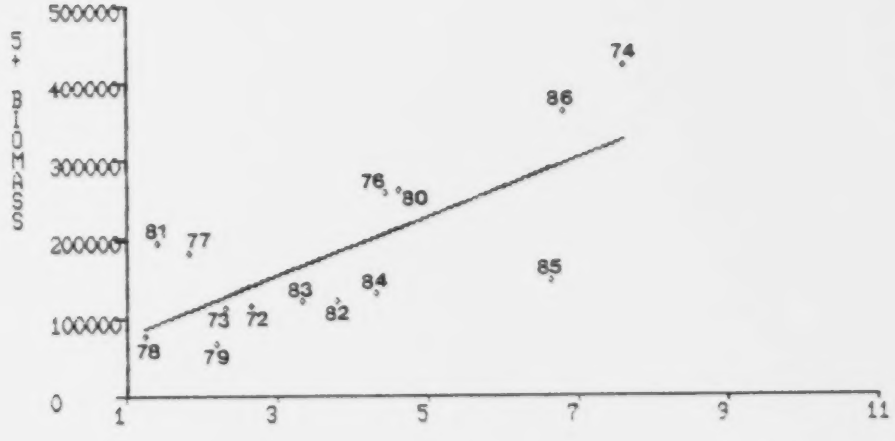


Fig. 3. "Tuning" plot of 4WX herring SPA derived mature and 5+ biomass vs larval abundance; 1972-1986.

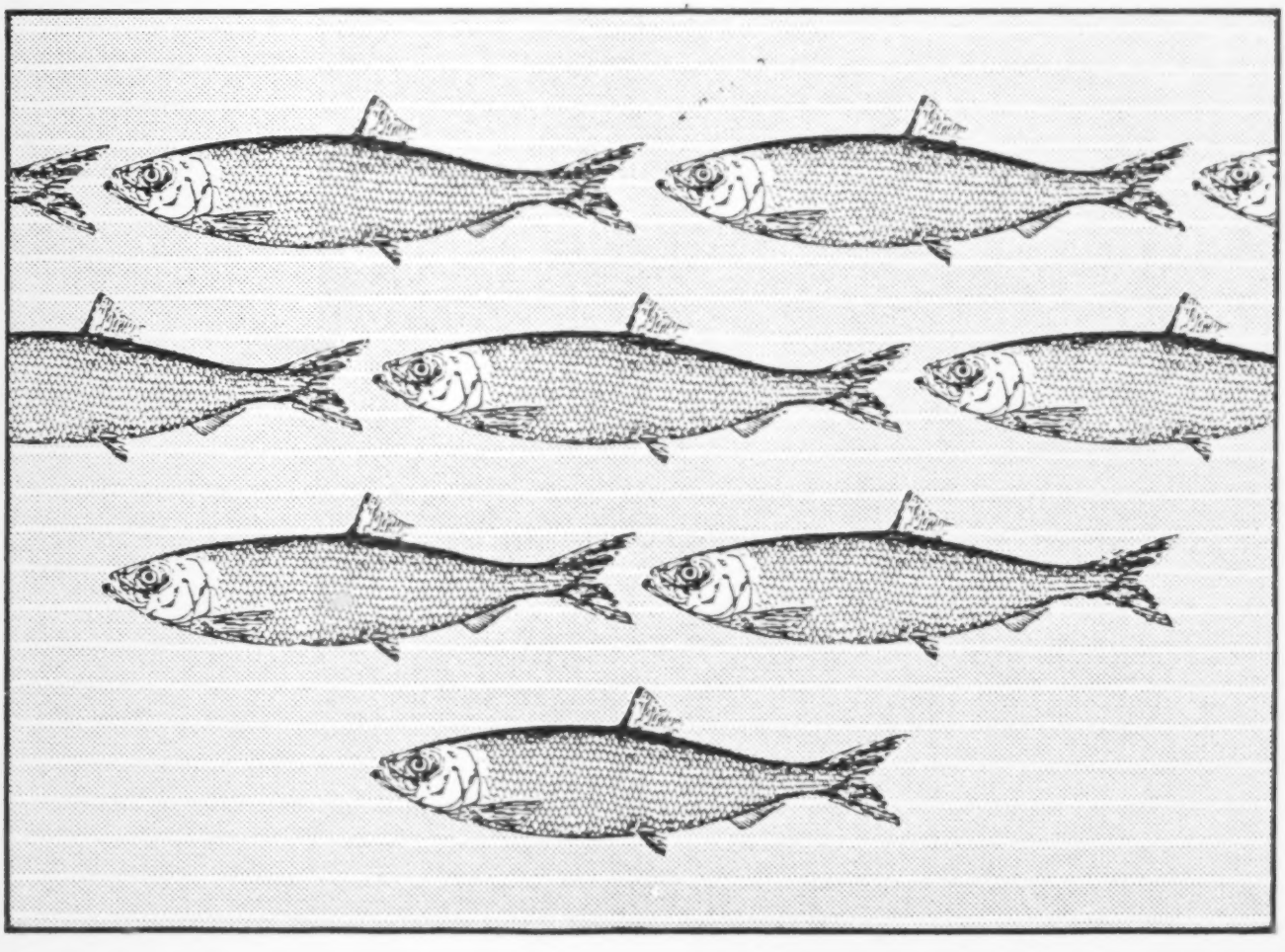
Fisheries and Oceans Pêches et Océans

APPENDIX I

Fisheries Management Plan: 1986

Scotia - Fundy Region

4WX Herring



Canada

1985-1986 4WX FISHERY MANAGEMENT PLAN

PART I

HERRING PURSE SEINE FLEET

A. GENERAL

THE TOTAL FLEET QUOTA FOR ALL SCOTIA-FUNDY PURSE SEINE VESSELS IN 4WX HERRING FISHERIES WILL BE 90,000 T FOR 1986 (OCTOBER 15, 1985 TO OCTOBER 14, 1986), WHICH EXCEEDS BIOLOGICAL ADVICE IF INSHORE ALLOWANCES AND UNREPORTED LANDINGS OCCUR AS IN 1985.

1. VESSEL QUOTA

All purse seine vessels shall operate on an annual vessel quota as defined below:

Class A - 1.6% of purse seine quota, 1,440 tonnes*
Class B - 2.7% of purse seine quota, 2,430 tonnes*

These figures do not account for quota purchases. For those vessels with quota purchases, the 1986 vessel quotas are as follows:

LADY MELISSA	-	3,600
TOMMIE & ARNIE	-	2,880
LISA ANNE	-	2,880
SEAFOAM I	-	3,600
LEROY & BARRY I	-	3,600
MARGARET ELIZABETH	-	3,600
CANADA 100	-	3,600
CPRD	-	1,710
MATTUNA MARINER	-	3,600
MARIE LYNN ANITA	-	3,600

All vessels which have purchased quota shares must have circulating chilling systems prior to obtaining the 1986 purchased quota amount.

* Subject to Part A 4(g) of this plan.

2. ALL VESSEL QUOTAS WILL OCCUR AS A CONDITION OF LICENSING.

3. PARTICIPATION

Any Scotia-Fundy purse seine vessel may participate in any or all of the following herring fisheries: 4W, 4X (fall), 4X (winter), 4X (summer). Restrictions will be limited to area quota and overall vessel quotas.

.../2

PART I (CONT'D)

A cont'd

4. MONITORING

Government/industry coordinated monitoring of the purse seine quota will occur through continual monitoring of all catches. The following procedures will be followed:

a) Industry/government monitoring of all nightly catches via verbal hail from each purse seine vessel captain identifying:

i) amount caught;
ii) port of unloading; and
iii) estimated time of unloading.

b) Written copy (DFO Landing Slip or Industry Delivery Note) of all verbal catch reports to be completed and forwarded to the industry/government central monitoring unit.

c) Accurate log records to be completed for each fishing trip and forwarded to DFO.

d) Purchase slip information to be completed by each purchaser and forwarded to DFO.

e) Fragmented (i.e., valid for specified periods) Condition of Licence Forms to be utilized in all purse seine fisheries within the Scotia-Fundy Region.

f) The fishery will be closed in the event of misreporting.

g) All documented individual vessel quota overruns in the 1985 fishery will be deducted from 1986 individual vessel quotas.

B. PURSE SEINE FISHERIES

1. SYDNEY BIGHT (4VN)

a) The season for purse seine vessels shall run from November 7, 1985 to March 1, 1986.

b) The quota will be 3,500 tonnes, to be taken by Gulf based purse seine vessels .

c) The area of activity shall be north and west of a line drawn from Pt. Aconi in Cape Breton to the 3Pn Division intersect with the 4Vn line.

d) The area east of the Pt. Aconi line in 4Vn shall not be fished by purse seine vessels.

.../3

PART I (CONT'D)

B cont'd

2. CHEDABUCTO BAY (4W)

a) The season for purse seine vessels shall run from November 7, 1985 to March 1, 1986.

b) The quota shall not exceed 18,000 tonnes, to be taken by Scotia-Fundy vessels.

c) The following closure line will be in effect until January 1, 1986, after which 40% (7,200 t) of the overall quota may be harvested inside this line. Waters of Chedabucto Bay in 4W lying west of straight line extending from Cape Canso at 45°18' north latitude, 60°56' west longitude to Green Island at 45°29' north latitude, 60°54' west longitude.

3. BAY OF FUNDY - FALL AND WINTER "BRIT" FISHERY

a) The fall and winter Bay of Fundy purse seine fisheries will be combined into one fishery with the following provisions:

(1) The season will be October 16/85 to March 31 of the next year.

(2) A total of 7,000 t will be assigned in the following manner:

(i) up to 6,000 t to be caught in the October 15 - December 31 portion of the fishery.

(ii) of the amount captured in (i) above, 50% will be counted against the quota up to a maximum of 3,000 t;

(iii) the "brit" fishery will comprise the second portion of the fall and winter Bay of Fundy purse seine fishery with a January 1 - March 31 season;

(iv) the quota for the 1986 "brit" fishery will be 1,000 t;

(v) all catches will be deducted from individual vessel quotas for the 1986 season (50% of fall catch + 100% of the "brit" catch).

b) The fishery will be closed when:

(1) quotas are reached;

(2) seasonal closures are reached; or

(3) irregularities in quality, size or end-product use.

.../4

PART I (CONT'D)

B cont'd

4. BAY OF FUNDY - SUMMER FISHERY

a) The season for purse seine vessels shall run from June 1, 1986 to October 14, 1986.

b) The quota will be (90,000t - (X+Y+Z)), to be taken by Scotia-Fundy vessels.

X = 4W catch
Y = fall 4X catch (50%)
Z = 4X winter "brit" catch

c) A separate bait quota of 2,600 t will be authorized for the 1986 fishing. The allocation of this allotment will be determined by the Advisory Committee in April 1986.

d) No purse seine fishery in Area 21 (June 1 - October 14) for 1986.

e) The Trinity Ledge spawning Area (Schedule III, Item 5 - Atlantic Coast Herring Regulations) will be closed to purse seine activities August 25 to September 7 for 1986.

f) Provision will be made prior to the beginning of the summer fishery to place controls on the upper limit of harvest and/or harvest intensity on the Trinity Ledge spawning area in response to concerns expressed regarding the potential biological implication of such intense roe harvest.

g) A Georges Bank purse seine fishery is authorized under the following conditions:

(1) fishing to occur in the Canadian zone of 5Ze;

(2) a DFO observer must be present on all trips;

(3) 24 hours' notice must be given to DFO prior to departure; and

(4) failure to comply with parts, (a), (b) and (c) will result in any catch being assigned to that vessel's 4X quota.

h) A 6,000 t Over-The-Side Sales Program will occur.

i) The provision for an Over-The-Side or Over-The-Wharf Sale of 4,000t of sex sorted males. This Program is for sorted male herring only and cannot be used in a quota manner to supplement any existing Over-The-Side Sale arrangement for purse seines or gill net fishermen.

PART II

SCOTIA-FUNDY (4X) INSHORE HERRING GEAR TYPES

A. GENERAL

1. All catch information shall be provided to the Department for each catch.

2. All purchase slip information shall be provided for each purchase and shall include identification of amount purchased, fisherman and date of purchase.

3. All Nova Scotia inshore gear (weirs, traps and gill nets) previously under quota control will be assigned an allowance of anticipated catch for 1986. This catch in 1984 approximated 7,500t, and for 1985, 10,500t.

4. No effort increases will occur in any inshore fishery.

5. All herring sold for bait will be recorded.

B. WEIR FISHERY

1. The Split Rock to Gannet Rock closure line will remain in effect from April 15, 1986, to September 30, 1986.

C. HERRING SET NET FISHERY

1. After the season, all moorings must be removed from the water.

D. HERRING DRIFT NET FISHERY

1. Licences for drift nets are limited to those holding same for 1983.

2. a) An Over-the-Side Sales Program for 5,000t is to occur.

   b) A cooperative agreement will occur between the two management groups for OSS (MFU and Fundy Coordinators) to ensure daily OSS capacity is filled.

3. An Over-The-Wharf Sales Program of 1,000t is to occur.

E. TRAP FISHERY

1. All mackerel traps in the 4X Area are limited to a 10% by-catch of herring up to a maximum of 100 t.

SUMMARY TABLE OF QUOTAS DIVISION FOR 1985

GEAR TYPE	AREA	SEASON	QUOTA	ALLOWANCE GUIDE
Purse Seine				
4X (Fall)	Bay of Fundy	October 15 - December 31/85	3,000*	
4X (Winter)	Bay of Fundy	January 1 - March 31/86	1,000	
4W	Chedabucto Bay	November 7/85 - March 1/86	18,000	
4X (Summer)	Bay of Fundy	June 1/86 - October 14/86	68,000	
			90,000	
4X Bait	Bay of Fundy	Sept. 15/86 - October 14/86	2,600	
Drift Gillnet	S.W. Nova	June 1/86 - October 15/86	5,000**	
Set Gillnet	S.W. Nova	June 1/86 - October 15/86		13,000
N.S. Weir	Nova Scotia	June 1/86 - October 15/86		
Traps	Liverpool Bay	February 1/86 - May 1/86		
TOTAL QUOTA			97,600	
TOTAL PROJECTED CATCH (QUOTA + ALLOCATION)				110,600

* Quota represents 50% of T.A.C.

** OSS quota which is deducted from allowance total.

Appendix II - Prognosis: 4WX Herring 1987-90

Age	PR	Mean wt (kg)	1986 population (numbers)	1986 catch (numbers)
1	.003	.009	1319777[1]	40
2	.36	.055	1054076[1]	80019
3	.75	.124	1823639	176197
4	1	.182	1477399	186983
5	1	.239	287297	36361
6	1	.271	159447	20180
7	1	.306	54345	6878
8	1	.329	21800	2759
9	1	.360	14846	1879
10	1	.400	6842	866

[1]Age 1 and 2 population numbers set to 1974-83 geometric mean.

Two projections were made:

A) Assuming a 1987 catch of 126,500 and $F_{0.1}$ = .3 thereafter:

	87	88	89	90
Quota	126,500	.3	.3	.3
Projected catch	126,500	159,800	140,900	126,500
F	.140	.183	.174	.167

B) Assuming 1987 and future years at $F_{0.1}$ = 3:

	87	88	89	90
Quota	.3	.3	.3	.3
Projected catch	166,500	149,200	133,300	121,400
F	.191	.179	.171	.165